Land Snail Survey of Select Niagaran Escarpment and Related Sites in Hiawatha National Forest, Mackinac County

Report Submitted to:
Derek Huebner
St. Ignace District
U. S. Forest Service
Hiawatha National Forest

Report Submitted by:
All Things Wild Consulting
Eric North
P.O. Box 254
Cable, WI 54821
xcskyr@hotmail.com

October 13, 2008

Introduction

Studies have shown, in Iowa, Wisconsin, Michigan and Ontario that the diversity of land snails on carbonate cliffs, with approximately 1/3 harboring 24 or more taxa, can be of global significance (Tattersfield, 1996). While many of these sites are pristine, others have been impacted by anthropogenic forces. Snail habitat is particularly susceptible to disturbance, especially changes in moisture, and has been shown to be some of the most fragile known to man (Frest and Johannes 1995). Logging can potentially cause drying by increasing the amount and intensity of wind and sun impacting a site. Since many snails rely on a cool, moist microclimate, any disturbance can be detrimental to they and their habitat. Therefore, any potential impacts need to be mitigated.

The St. Ignace District of the Hiawatha National Forest solicited surveys to provide guidance in their new management plan for this area. Sites surveyed were contained within management blocks proposed to be harvested for timber. Data gathered would be used to prioritize sites for protection, including limiting the type of harvesting and implementing buffers around the sites. Additionally, biologists were trying to develop methods to assess the quality of habitat and likelihood of high snail diversity or sensitive species when surveying potential sites in the future. This assessment would hopefully be done without the time-consuming process of a complete site survey for snails, and could be done by a Forest Service Wildlife Biologist or technician.

This report summarizes the results of surveys performed from May 8-11, 2008 in Mackinac County. These sites were mainly ledges, cliffs and fractured pavement associated with Devonian-age Niagaran Escarpment limestone. These results will not only inform managers, but also provide a better understanding of the distribution of rare land snail species in Michigan.

Methods

Sites were selected by following recommendations by Derek Heubner, Wildlife Biologist for the Hiawatha National Forest. This list was compiled by surveying other biologists and foresters with the St. Ignace office. Many sites were also added by referencing a list of sites that were surveyed for Heart's Tongue Fern, a federally listed species. These sites were then prioritized based on site quality and ease of access to maximize the number of highest priority (and/or quality) sites that would be included in this survey.

Surveys were completed May 8- May 10, 2008. A total of 27 sites were visited and described as part of the survey. 13 of the 27 sites were sampled to determine species diversity. Sites visited by previous researchers were excluded, as data already exists. The decision to sample a site for diversity was based on microclimatic, geologic and vegetative parameters that have been shown to indicate high species diversity. Sites of lesser apparent quality were also included in an attempt to more precisely establish parameters for biologists to use when identifying potential habitat.

Field Methods

At each site, photos were taken and the general geology of the site was described. General canopy, understory and groundcover species were noted along with a rating potential (from 1 to 5) to see if the apparent attributes of the site expressed themselves in species richness or diversity. Slope and aspect were noted to potentially show relationships with diversity. Groundcover noted was only the most common species and was intended to give a general sense of the soil richness of the site. At each site, one 4L sampling bag was filled with leaf litter from the most favorable microhabitats. Those include interstitial spaces, moss-covered ledges, pockets under and within talus, and fractures or fissures. Any of these that contain cool, moist organic soil or leaf litter are excellent candidates. Where applicable, as many of these different microhabitats were sampled at a site.

Lab Procedures

Each bag is then dried at 250 F for 24 hours. They are then sieved through a standard sieve series (ASTME 9.5 mm, 2.0 mm, .85 mm and .425 mm) and picked against a neutral background tray. All shells and shell fragments were removed, including immatures. Shells were then sorted and identified using a compound binocular microscope with 100x capability. Identifications follow Pilsbry's Land Mollusca of North America (1948). All shells were identified to the highest level possible. Specimens will be housed either at the Hiawatha National Forest office in St. Ignace or at the collections of All Things Wild Consulting (see address and contact information on cover page).

Site Descriptions

Ledge Crop
UTM 16 T 0670047 5107855
This site was a 1-2 m tall ledge associated with many other 1-3 m scattered boulders. On top of the ledge were some other fractures and fissures that were also sampled.
Overstory: Acer, Fagus
Ground Cover: Erythronium, Claytonia virginica
Aspect: 61 Slope: 0
Rating: 1/2
Species Noted:

Anguispira alternata
Columella simplex
Cochlicopa lubrica
Discus catskillensis
Euconulus alderi
Euconulus polygyratus
Gastrocopta contracta
Glyphylinia indentata
Hawaiia miniscula
Helicodiscus paralellus
Helicodiscus shimeki
Nesovitrea binneyana
Nesovitrea electrina
Paravitrea multidentata
Stenotrema cf. fraternum
Striatura exigua
Striatura milium
Strobilops labyrinthica
Zonitoides arboreus
Vertigo gouldi

Kenneth Rd. Cliff
UTM 16 T 0663703 5107414
A 2-3 m limestone ledge, with a subtending talus slope with 1-2 m class boulders characterize this site. There were many mossy ledges on the cliff face and many interstitial spaces in the talus.
Overstory: Thuja, Acer
Ground Cover: Maianthemum canadense, Claytonia virginica
Aspect: 222 Slope: 4
Rating: 3/4
Species Noted:

Anguispira alternata
Carychium exile canadense
Discus catskillensis
Euconulus fulvus
Helicodiscus paralellus
Nesovitrea binneyana
Punctum minutissimum
Striatura milium
Strobilops labyrinthica
Vitrina limpida
Zonitoides arboreus
Vertigo gouldi
Vertigo paradoxa

Kenneth Rd. Alvar

This site is directly adjacent to the Kenneth Rd. cliff site. Along the top of the cliff, on the way back toward the road, this sample was taken to determine the potential of fractured bedrock to hold unique snail faunas.

Species Noted:

Cochlicopa lubrica
Discus catskillensis
Euconulus fulvus
Helicodiscus paralellus
Nesovitrea binneyana
Striatura exigua
Striatura ferrea
Strobilops labyrinthica
Vertigo sp.
Vitrina limpida
Zonitoides arboreus

Heart's Tongue Alvar

UTM 16 T 0670963 5109156

This site was a rich upland maple stand with many deep fissures in the bedrock. Heart's Tongue Fern was located at the site as well.

Overstory: Acer, Fagus

Ground Cover: Trillium grandiflorum, Viola, Allium tricoccum

Aspect: 2 Slope: 1

Rating: 2

Species Noted:

Columella simplex
Discus catskillensis
Gastrocopta contracta
Glyphylinia indentata
Helicodiscus paralellus
Paravitrea multidentata
Striatura exigua
Striatura milium
Strobilops labyrinthica
Vitrina limpida
Zonitoides arboreus
Zoogenetes harpa
Vertigo gouldi

Maple Hill South

UTM 16 T 0670919 5113136

This site was a 1-2 m mossy limestone outcrop/ledge. There was also a 2 m deep fissure and other associated fissures nearby with good cover. Maple Hill is nearby and is known to be very malacologically diverse (Nekola, 1998) and is being protected by the Forest Service.

Overstory: Acer, Fagus

Groundcover: Viola sp., Allium tricoccum, Claytonia virginica, Dicentra cucullaria

Aspect: 226 Slope: 4

Rating: 3

Species Noted:

Anguispira alternata
Discus catskillensis
Euconulus fulvus
Helicodiscus paralellus
Nesovitrea electrina
Paravitrea multidentata
Columella simplex
Striatura exigua
Stritura milium
Strobilops labyrinthica
Vertigo gouldi
Vitrina limpida
Zonitoides arboreus

East Lake
UTM 16 T 0668623 5109271
This site consisted of .5-3 m class boulders in a rich upland woods. Trees at this site could possibly be old growth. There were no fissures or exposed bedrock, just the large boulders.
Overstory: Acer, Fraxinus
Groundcover: Viola sp., Allium tricoccum, Polypodium
Aspect: 44 Slope: 2
Rating: 2
Species Noted:

Anguispira alternata
Columella simplex
Discus catskillensis
Euconulus fulvus
Glyphylinia rhoadsii
Helicodiscus paralellus
Nesovitrea binneyana
Paravitrea multidentata
Striatura exigua
Striatura ferrea
Strobilops labyrinthica
Vertigo gouldi
Vertigo paradoxa

Deer Blind Pond
UTM 16 T 0688091 5106033
This site was a Thuja occidentalis gallery forest, with class sizes 15-35 cm dbh. There was a 1-1.25 m high very mossy limestone ledge, with some very good interstitial spaces on the cliff face. Thuja and Abies were on the cliff face.
Overstory: Thuja occidentalis, Betula papyrifera
Groundcover: Sphagnum sp.
Aspect: 238 Slope: 6
Rating: 3/4
Species Noted:

Anguispira alternata
Columella simplex
Discus catskillensis
Euconulus fulvus
Euconulus polygyratus
Glyphylinia indentata
Hawaiia miniscula
Helicodiscus paralellus
Nesovitrea electrina
Striatura exigua
Striatura milium
Strobilops labyrinthica
Vertigo gouldi
Vertigo paradoxa
Zonitoides arboreus

No Leeks
UTM 16 T 0687301 5107431
This site consisted of a small, 100 m^2 Alvar with 2 m deep fissures and exposed moss-covered bedrock. Within the fissures, there was very good litter, hummus and organic soil, similar to soil that would be preferred by snails in interstitial spaces in talus.
Overstory: Acer, Fagus
Groundcover: Maianthemum, Viola
Aspect: 0 Slope: 0
Rating: 2
Species Noted:

Cochlicopa lubrica
Discus catskillensis
Euconulus fulvus
Gastrocopta contracta
Helicodiscus paralellus
Paravitrea multidentata
Stritura exigua
Striatura milium
Strobilops labyrinthica
Vertigo gouldi
Zoogenetes harpa

Fern Cliff

UTM 16 T 0689814 5101069

This site was a .5-1.5 m tall ledge, which was very mossy , with some fissures on front and on top of the cliff. However, the productivity was questionable due to the composition of the overstory.

Overstory: Picea, Betula

Understory: Picea

Groundcover: Vaccinium

Aspect: Semi-circle Slope: -1

Rating: 1

Species Noted:

Anguispira alternata
Columella simplex
Discus catskillensis
Euconulus fulvus
Helicodiscus paralellus
Paravitrea multidentata
Punctum minutissimum
Striatura exigua
Striatura ferrea
Striatura milium
Strobilops labyrinthica
Triodopsis albolabris
Vertigo gouldi

Little Dome
UTM 16 T 0686419 5101749
This site was a 20 m diameter, 2-2.5 m high domed limestone outcrop. It was highly fissured up to 2m deep, with moss and soil filling the interstitial spaces. Good litter, hummus and interstitial spaces made this a very unique and impressive site. Most of the sampling was done on the north-facing side of the dome, where it was more shaded and protected.
Overstory: Acer, Tsuga, Thuja
Understory: Fagus
Groundcover: Claytonia virginica, Dryopteris, Maianthemum
Aspect: circular Slope: 0
Rating: 3
Species Noted:

Cochlicopa lubrica
Discus catskillensis
Euconulus polygyratus
Gastrocopta contracta
Helicodiscus paralellus
Paravitrea multidentata
Punctum minutissimum
Striatura exigua
Striatura ferrea
Vertigo sp. (immature)
Vitrina limpida
Zonitoides arboreus

Little Ledge
UTM 16 T 0675723 5108668
This site was a 20 m long by 1 m high ledge that was very mossy and moist. There was some interstitial spaces on the ledge itself and also some fracturing on the top of the ledge.
Overstory: Acer, Fagus
Groundcover: Allium tricoccum, Erythronium, Claytonia virginica, Dentaria, Trillium grandiflorum
Aspect: 16 Slope: -1
Rating: 1
Species Noted:

Anguispira alternata
Cochlicopa lubrica
Discus catskillensis
Glyphylinia rhoadsii
Helicodiscus paralellus
Nesovitrea binneyana
Paravitrea multidentata
Punctum minutissimum
Striatura exigua
Striatura milium
Strobilops labyrinthica
Triodopsis albolabris

Rubble
UTM 16 T 0675663 5107918
This was a highly fractured area with many .5-1.25 m boulders covered with moss and a think litter layer. There were many interstitial spaces, and the fractures were covered by litter. Most of the moss was quite dry, so the productivity of the site was not readily apparent.
Overstory: Acer with one Thuja
Understory: Fagus, Abies
Groundcover: Erythronium, Polypody
Aspect: None Slope: 0
Rating: 1
Species Noted:

Anguispira alternata
Cochlicopa lubrica
Columella simplex
Discus catskillensis
Euconulus fulvus
Euconulus polygyratus
Nesovitrea electrina
Paravitrea multidentata
Striatura exigua
Striatura ferrea
Striatura milum
Strobilops labyrinthica
Vertigo gouldi
Vertigo paradoxa
Vitrina limpida
Zonitoides arboreus

Stumble
UTM 16 T 0663972 5107143
This site was a rich, rocky woodland with a 1-2.5 m moss-covered (about half) ledge outcrop that did not have many fractures. There was a bit of fracturing on top of the ledge, as well as many .25- 1 m boulders associated with the outcrop. Nearby was another smaller .5 m ledge.
Overstory: Acer, Fagus
Understory: Abies
Groundcover: Erythronium
Aspect: 237 Slope: 0
Rating: 2
Species Noted:

Anguispira alternata
Cochlicopa lubrica
Discus catskillensis
Euconulus fulvus
Euconulus polygyratus
Glyphylinia indentata
Helicodiscus paralellus
Nesovitrea binneyana
Paravitrea multidentata
Punctum minutissimum
Pupilla muscorum
Striatura exigua
Striatura ferrea
Striatura milium
Strobilops labyrinthica
Vertigo gouldi
Vertigo paradoxa
Vitrina limpida

Sites not sampled

Nothing 1
UTM 16 T 0689688 5101100
This site was bedrock pavement at a snowmobile trail with only small (.25-.5 m) boulders laying singly under a Picea and Betula overstory. There was no understory or groundcover. There were small fissures in the pavement, but they were in the sun and therefore too xeric to support snails.
Not sampled
Rating: 0

Nothing 2
UTM 16 T 0690216 5100756
Small, 30 m^2 domed outcrop with some very deep fissures, but the whole site is quite exposed to sun and wind. This was the basis for not sampling. There was a very thick layer of lichens present.
Not Sampled
Rating: 0

Nothing 3
UTM 16 T 0679685 5108540
This site had sparse random boulders with one 5 m^2 pile. However, it seems to have been harvested in the last 15 years, leaving Picea and Betula. The site is very exposed, and so not a good prospect for snails.
Not Sampled
Rating: 0

Nothing 4
UTM 16 T 0678312 5106407
This was a very young Acer-Fagus forest with few scattered .25-.5 m boulders. There were no microhabitats present to support land snails.
Not Sampled
Rating: 0

Nothing 5
UTM 16 T 0676374 5108637
This was an upland Acer-Fagus forest with a very rich spring wildflower flora. There were, however, no boulders, rocks or fissures, and so would not support an unusual snail fauna.
Not Sampled
Rating: 0

Nothing 6
UTM 16 T 0676258 5108954
The north side of the road at this site has only one ~20m area with boulders .5-3 m tall, with no fissures or interstitial spaces. The woods themselves were a very rich Fagus-Acer upland. There was abundant Polypody on the boulders. The south side of the road here

had many more boulders and was much better habitat, but was not part of the management areas.
Not Sampled
Rating: 1

Nothing 7
UTM 16 T 0674866 5107206
This site was Thuja over a very small 60 m^2 area of fracturing and ~30 boulders. There were a number of other sites that had been sampled that were representative of the same habitat type and quality, so this site was not sampled to try to include other examples of potential habitat.
Not Sampled
Rating: 0/1

Nothing 8
UTM 16 T 0672093 5106806
At this site there was one Thula in a primarily Acer overstory. There was a small limestone outcrop and some fracturing, but the fractures were all buried under matted leaf litter and there were no microhabitats found on the ledge.
Overstory: Acer, Thuja
Understory: Abies
Groundcover: Erythronium, Claytonia virginica
Not Sampled
Rating: 1

Nothing 9
UTM 16 T 0663915 5106933
This site had very few scattered .25 m class boulders.
Overstory: Acer
Understory: Abies
Not Sampled
Rating: 0

Nothing 10
UTM 16 T 0664261 5110732
There were no rocks, boulders, or fractures associated with this site, and actually appears to be a good stand to harvest.
Overstory: Acer, Betula
Understory: Abies, Fagus
Groundcover: Erythronium
Not Sampled
Rating: 0

Nothing 11
UTM 16 T 0665047 5110333

This was a collection of 30 or so .25-1.75 m class boulders in an area with no exposed bedrock and really no particularly promising microhabitats for snails.
Overstory: Acer, Abies
Understory: Abies
Groundcover: Dryopteris, Erythronium
Not Sampled
Rating: 0

South side of Rd.
UTM 16 T
This site was very mossy pavement with numerous large fissures, and very promising habitat but was not in the harvest block.
Not Sampled
Rating: 2

Huron NE
UTM 16 T 0689274 5107653
This was a very wet mixed-deciduous forest, with very few boulders.
Overstory: Picea, Pinus, Betula
Not Sampled
Rating: 0

Tongue
UTM 16 T 0691154 5102460
This site was a 50-60 m long “tongue” of exposed bedrock .5-1.5 meters tall, with very mossy 1 m deep weathered fissures.
Overstory: Betula papyrifera, Picea sp.
Groundcover: Coptis, moss
Aspect: 57 Slope: 10
Rating: 1

Rocky Woods
UTM 16 T 0686189 5101344
This site contained scattered .25-1.5 m class boulders all sitting singly with no real interstitial spaces or fracturing bedrock.
Overstory: Acer, Tsuga
Understory: Fagus
Groundcover: Maianthemum
Not Sampled
Rating: 0

Fern Rock
UTM 16 T 0674207 5108581
This site was a small collection of very large boulders, some over 3 m diameter. The boulders were mossy but there were no interstitial spaces to provide microhabitats. Additionally, there was a high degree of rodent traffic, which also negatively affects snails, both through competition for resources and through predation.
Not Sampled
Rating: 0

Results

Twenty-seven sites were visited for this survey. Thirteen of the 27 sites were sampled for snail diversity analyses. The most diverse site was Ledge Crop, with 20 taxa. The least diverse sites were No Leeks and Kenneth Rd. Alvar with 11 each. Four of the sites had 15 or more taxa, which is highly significant diversity. The mean diversity score was 13.85 species per site. Two Regional Forester Sensitive Species for the Hiawatha Ranger District were located, Euconulus alderi and Vertigo paradoxa. Euconulus alderi was located at one site, while Vertigo paradoxa was located at 5 stations. No additional taxa were added to the state or local fauna. However, since 21 stations were previously known for Vertigo paradoxa, these five additional sites represent an increase of nearly 20%.

Discussion

Perhaps most notable of this whole survey was how poorly the rating scores predicted the snail diversity at a site. One of the most difficult things of land snail research is how to sample effectively. When trying to maximize diversity in a survey, often times a number of sampling methods may be used. With experience though, a researcher can become familiar with the proper microhabitats to sample within whatever habitat type is being sampled. That being said, it is still difficult to predict how diverse a site is going to be. There are many factors that simply cannot be observed, although a general sense of potential diversity is still possible.

Determining, based on certain indicators, the likelihood of a site being malacologically diverse or harboring rare taxa has been attempted before. More accurately, many sites have been sampled for diversity and then corresponding data been gathered on geologic, vegetative, soil, light, temperature and aspect variables. While studies have shown certain variables to be important, none have been consistently shown to be predictive. That said, there are a number of factors that will often be indicative of a favorable site.

A site must be somewhat stable and not have been disturbed in recent times, in fact, the longer the site appears to have been without disturbance, the better. Snails need a cool, moist microclimate. Weather that microclimate is in a fracture in bedrock, a fracture in a small ledge, or a moss-covered ledge on a 4 m tall cliff. If sampling a cliff, sample from all available microclimates- top of the cliff, the cliff face (moss-covered ledges), the foot of the cliff, and the subtending talus (if available). Grab leaf litter that is at the very bottom of the mat, where it is cool and moist, and not necessarily bound together by roots or fungal hyphae. If sampling fractures, try to find cool moist leaf litter or even very dark organic soil. Moss-covered ledges can often be productive in these habitats as well.

While this survey did not expand the fauna of Mackinac County, the addition of 5 populations of Vertigo paradoxa and one of Euconulus alderi point out how important the work was. Northern Michigan has by far the most populations of Vertigo paradoxa globally. This fact should not be taken lightly. The habitats where this taxa are found should be afforded the highest protection for their natural features and their flora and fauna. The rarity of this species alone has prompted other researchers to call for its' listing as federally endangered (Frest and Johannes 1991).

References

Pilsbry, H.A. 1948. *Land Mollusca of North America (North of Mexico).* Academy of Natural Sciences of Philadelphia, Monograph #3.

Frest, T.J. and E.J. Johannes. 1995. Interior Columbia Basin Mollusk Species of Special Concern. Final Report, Contract #43-0E00-4-9112, Interior Columbia Basin Ecosystem Management Project, Walla Walla, Washington.

Tattersfield, P. 1996. Local patterns of land snail diversity in a Kenyan Rain Forest. *Malacologia*. 38:161-180.

Frest, T.J. and E.J. Johannes. 1991. *Land Snail Survey of the Black Hills National Forest, South Dakota and Wyoming*. Final Report, Contract #43-67TO-2-0054, USDA Forest Service, Black Hills National Forest and USDI Fish and Wildlife Service, South Dakota State Office.